Bruker BioSpin

BLAXH2H500/100/250 E

Amplifier 700-900MHz INR
Operating & Service Manual

Version 002

think forward

NMR Spectroscopy

The information in this manual may be altered without notice.

BRUKER BIOSPIN accepts no responsibility for actions taken as a result of use of this manual. BRUKER BIOSPIN accepts no liability for any mistakes contained in the manual, leading to coincidental damage, whether during installation or operation of the instrument. Unauthorised reproduction of manual contents, without written permission from the publishers, or translation into an other language, either the entire manual or a part of it, is forbidden.

This manual describes the units as they are at the date of printing. On request, the manufacturer shall supply circuit diagrams, lists of components, descriptions, calibrating instructions and any other information for use by qualified personnel of the user, in charge of repairing the parts of the unit which have been stated by the manufacturer to be "repairable". Such supply shall in no event constitute permission to modify or repair the units or approval of the same.

This unit is not designed for any type of use which is not specifically described in this manual. Such use may be hazardous.

This manual was written by

Bernard Geissert

This manual was edited and desktop published by

Dominique Wurtz

Wissembourg, France

P/N: Z31798
DWG-Nr: Z4D10072A

For further technical assistance on the BLAXH2H500/100/250 E unit, please do not hesitate to contact your nearest BRUKER dealer or contact us directly at:

BRUKER BioSpin
34 rue de l'Industrie
F-67166 Wissembourg Cedex
France

Phone: + 33 388 066 000
Fax: + 33 388 736 820
Email: support-rmn@bruker.fr
Internet: www.bruker.com

Contents

Contents 3

1 General Information 5

1.1 Introduction 5

2 Safety 7

2.1 Identification Labels 7
Identifying Plate 7
Manufacturer's Name Plate 8
2.2 Safety Labels and Symbols 9
Warning Signs 9
Danger 9
Instruction 9

3 Installation 11

3.1 Initial Inspection 11
Mechanical Check 11
Claim for Damage 11
Reshipment and Repackaging Requirements 11
Environment Requirements 12
3.2 Installation Requirements 12
Bench Operation 12
3.3 Power Requirements 12
3.4 System Check 12
3.5 Initial Turn on Procedure 13

4 Operation 15

4.1 Front Panel Description 15
Indicators 15
Coaxial Connectors 16
Ethernet 10/100 Interface Connector 16
Device Front View 17
4.2 Rear Panel Description 18
Device Rear View 18

5 Technical Description 19

5.1 System Overview 19
5.2 Theory of Operation 22
RF Path 22
Embedded Input Router 22
RF Power amplifier Channel X500 22
RF Power Amplifier Channel H100 23

Circulator on channel H100 23
RF Power Amplifier Channel 2H250 23
2H RF Power Switch 23
RF Coupler X and H 23
BLA Control Board 24
2H-E Supervisor Board 26
BLA Extension Board 26
Status Led Board 26
BIS Board 26

6 Servicing the BLA 27

6.1 Accessing the BLA Amplifier 27
6.2 Sub Toolbar Information 28
Device Information (default) 28
Amplifier Status 29
6.3 Sub Toolbar Advanced Operations 30
Device Information (advanced) 30
Amplifier Limitations 31
Change Limits 32
Routing Information and Setting 33
6.4 Sub Toolbar Maintenance 34
Device Information (maintenance) 34
Self-Test & Software Reset 35
Firmware Update 37
BIS Content 38

7 Specifications 39

7.1 Common Characteristics 39
7.2 General Specifications 40
Channel X 500W Output 40
Channel H 100W Output 41
Channel 2H 150W Output 42

8 Service Information and Maintenance 43

8.1 Preventive Maintenance of the RF Module on BLA-Type Amplifiers .. 43
Operation 43

Figures 45

Tables 47

General Information 1

Introduction 1.1

The BLAXH2H500/100/250 E is a linear broadband pulse power amplifier specifically designed for Nuclear Magnetic Resonance (NMR) applications for 16.4 to 21.2 Teslas Systems. It is commercialized under the BRUKER part number W1345097.

Operating linear class AB, it provides 500W peak power output over the frequency range 6-365MHz on the X channel output, 100W peak power output over the frequency range 650 to 900MHz on the H channel output and 250W peak power output over the frequency range 105-155MHz on the 2H channel output.

The amplifier is realized by employing N-CHANNEL MOS BROADBAND RF POWER FETs of the latest generation. The unit can provide full power for any combination of pulse width / duty cycle up to 100ms / 25% for the H100 channel, 60ms / 6% for the X500 channel and 5ms / 10% for 2H250 channel.

Its built-in protection circuitry will allow lower power pulses for longer pulse widths and duty cycles, maintaining a 30W X channel, a 25W H channel and a 25W 2H channel average power.

An electronic protection circuitry has been designed to protect against:

Excessive power output level (overdrive)

- Excessive pulse repetition rate (over duty-cycle protection)
- Excessive pulse duration (over pulse-width)
- More than 50% reflected RF power (mismatch $\geq$ 6)
- Thermal overload (overheat).
- The 2H channel is not protected against reflected RF power and excessive power output level.

The amplifier is powered by an internal switched power supply assembly that provides the +32VDC for the power amplifiers, in addition to all low level voltages for the system.

The supply is self protecting for overcurrent and overvoltage.

The entire unit is housed in a 19″, 3U, 520mm rack cabinet.

Safety

2

The BLAXH2H500/100/250 E Amplifier 700-900MHz INR is in accordance with the standard 61010-1 and with the UL 61010-1 / CSA C22.2 No.61010-1-04 Safety Requirements for Electrical Equipments.

Identification Labels 2.1

Labels are provided to alert operating and service personnel to conditions that may cause personal injury or damage to the equipment from misuse or abuse. Please read the labels and understand their meaning.

Identifying Plate 2.1.1

The BLAXH2H500/100/250 E Amplifier 700-900MHz INR can be identified by an identifying plate at the front panel of the unit that contains the following information :

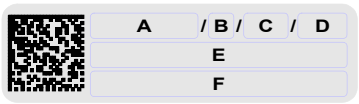

Figure 2.1. Identifying Plate

- **(A) Part Number**
  This field indicates the part number of the product.
- **(B) Variant**
  This field indicates the variant number that identifies the production category of the product. The default variant is 00.
- **(C) ECL**
  This field indicates the revision number that identifies the product configuration. The initial revision is 0.00.
- **(D) Serial Number**
  This field indicates the serial number of the product.
- **(E) Type**
  This field contains the designation of the product.
- **(F) Information**
  This field contains additional information about the product.

Manufacturer's Name Plate *2.1.2*

The BLAXH2H500/100/250 E Amplifier 700-900MHz INR can be identified by a manufacturer's name plate at the back panel of the unit that contains the following information :

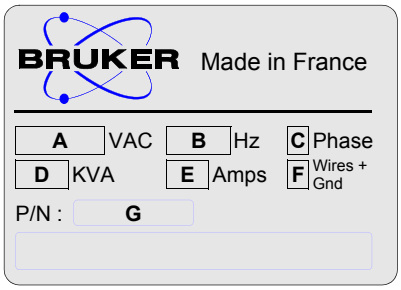

Figure 2.2. Manufacturer's Name Plate

- **(A) Voltage**
  This field indicates the input mains voltage of the product.
- **(B) Frequency**
  This field indicates the input mains frequency of the product.
- **(C) Phases**
  This field indicates the number of phases of the mains.
- **(D) Power**
  This field indicates the absorbed power of the product.
- **(E) Current**
  This field indicates the absorbed current of the product.
- **(F) Wires**
  This field indicates number of wires with the ground in the mains cord.
- **(G) Part Number**
  This field indicates the assembly number that identifies the part number of the product.

Safety Labels and Symbols 2.2

Warning Signs 2.2.1

Danger

DANGER! Risk of electrical shocks

Throughout this manual, this symbol indicates the possibility of severe personal injury, loss of life or equipment damage if the instructions are not followed.

On the equipment, the symbol also implies a danger and alerts the user.

Instruction

Operating personal should not remove RF output cable without turn off the power supply because the RF output can cause serious burns before the "Mismatch" protection is active.

Please disconnect the mains supply before opening to prevent potential hazard such as :

- Electrical shock from power supply
- Contact burns from the RF module and heatsink
- Finger scratch due to the fan assembly on the RF module.

Installation 3

The installation of the device must be done only by an authorized and qualified technician, in total accordance with the running standards.

BRUKER BIOSPIN assumes no liability for the customer's failure to comply with these requirements and is therefore not responsible or liable for any injury or damage that occurs as a consequence of non-approved installation.

Initial Inspection 3.1

Mechanical Check 3.1.1

If damage of the shipping cardboard is evident, request the carrier's agent to be present when the instrument is unpacked. Check the equipment for damage and inspect the cabinet and panel surfaces for dents and scratches.

Claim for Damage 3.1.2

If the unit is mechanically damaged or fails to meet specifications upon receipt, notify BRUKER or our representative immediately. Retain the shipping cardboard and packing material for the carriers inspection as well as for subsequent use in returning the unit if necessary.

Reshipment and Repackaging Requirements 3.1.3

Whenever possible, the original cardboard and packing material should be used for reshipment. If the original packing material is not available, wrap the instrument in heavy paper or plastic. Use a strong shipping container. If cardboard is used, it should be at least 200 lbs. test material.

Use shock absorbing material around all sides of the instrument to provide a firm cushion and to prevent movement from inside the container wall on each side. Protect the front panel by means of cardboard spacers inserted between the front panel and the shipping cardboard. Make sure that the instrument cannot move in the container during shipping. Seal the cardboard box with a good grade of shipping tape and mark the container :

"FRAGILE ELECTRONIC INSTRUMENT"

Environment Requirements *3.1.4*

This amplifier is built for inside use only on a maximum elevation of 2000m above sea level (6600 feet).

No specific cooling or ventilation is required.

Be sure that the amplifier has enough area around it so that the free airs flow into and out of the amplifier is not obstructed.

It should, however, be in an environment which conforms to the 5°C - 45°C (41°F - 113°F) thermal specifications, a 80% maximum relative humidity of air and a contamination level of two (means a normal non-conductive contamination, temporary conductivity due to condensation is possible).

Installation Requirements *3.2*

No special precautions are necessary. Mount the equipment in an area which is relatively free of vibration, and has sufficient room for cable connections.

The amplifier has a class II installation category.

Bench Operation *3.2.1*

The unit can be placed onto a secure flat surface.

Power Requirements *3.3*

The BLAXH2H500/100/250 E Amplifier 700-900MHz INR has a built-in switched power supply.
The mains line connector on the rear panel is a CEI 10A.

One Phase Line requirements :

AC input voltage :	208-230VAC
Input current max :	4,8A
Frequency :	50/60Hz

System Check *3.4*

Before applying power for the first time the following items should be checked:

- The AC input voltage 208-230 VAC ± 10% range must be compatible with the power supply.
- An external blanking (gating) pulse must be supplied to the amplifier in order for the unit to function. Ensure that this pulse has a proper level and logic polarity.
- The BLAXH2H500/100/250 E Amplifier 700-900MHz INR has a nominal input level of +4dBm. Ensure that the system drivers are operating at these levels.
- Output RF loads are connected.

Initial Turn on Procedure *3.5*

The following list describes how to turn on the BLAXH2H500/100/250 E Amplifier 700-900MHz INR and what should be seen as this occurs.

Before starting this procedure, make sure that you have properly followed the instructions in section ***"System Check" on page 12***.

1. Connect the amplifier to the AC line and turn the line switch to ON.
2. Observe the indicators on the front panel of the amplifier :
   - The +32V ON LED's will illuminate,
   - The +15V, -15V and +3,3V ON LED's will illuminate.
3. System is now fully operational.

Operation 4

Front Panel Description 4.1

The BLAXH2H500/100/250 E Amplifier 700-900MHz INR front panel is provided with 2 x 13 indicators for status monitoring, 13 coaxial connectors, 2 interface connectors and 1 line switch.

Indicators 4.1.1

Normal operation is indicated when following LED's are ON.

Table 4.1. Indicators Assignment

+32V	Indicates that the +32V supply is applied.
+15V	Indicates that the +15V supply is applied.
-15V	Indicates that the -15V supply is applied.
+3,3V	Indicates that the +3,3V supply is applied.
Overdrive	Indicates when the peak power limit has been reached.
Duty Cycle (D.C.)	Indicates when the duty cycle limit has been reached.
Pulse Width (P.W.)	Indicates when the pulse width limit has been reached.
Mismatch	Indicates when the max. reflected power limit has been reached.
RF POW. FLT	Indicates when one of the above limits has been reached.
Overheat	Indicates that the thermistor located on the RF module heatsink has sensed excessive heatsink temperature. The amplifier is blanked until an accepable temperature is reached. The function is self-resetting and no maintenance is needed. Indicates also that a fan on the assembly stops turning. The amplifier is blanked until fans are changed.
Channel ON	Indicates when the RF Power is present on the H channel or X channel.
2H ON	Indicates when the RF Power is present on the 2H channel.
2H Error	Indicates when an error has occured on the 2H channel. This could be a: - Duty cycle error, - Pulse width error. This Led is also coupled with the overheat error.

Coaxial Connectors *4.1.2*

Table 4.2. Coaxial Connectors Assignment

IN1, IN2, IN3	RF input of the embedded router, SMA type connector (female). Default entries are : - IN 1 to channel H and allows the channel to deliver full power at nominal +4dBm drive. - IN 2 to channel X and allows the channel to deliver full power at nominal +4dBm drive.
FX IN	Connection from SGU auxiliary RF output. This is the input of the 2H amplifier.
FO IN	Connection from the L-TX 2H-TR. This is the 2H lock signal.
X OUT / H OUT	RF output N type connector (female).
2H OUT	Connection to the HPPR 2H-module. This is either the output of the 2H amplifier and the 2H lock signal.
BLNK X / BLNK H **BLNK 2H**	Blanking signals of channel X, H or 2H, BNC type connector (female). TTL logic, 5V = blanking ON, 0V = blanking OFF. When BLANKING signal is at TTL level high (+5V), no gating is applied to the amplifier stages, and no RF Power is possible. When BLANKING signal is at TTL level low (0V), the amplifier stages are gated and RF Power is possible.
LTX BLNK	Connection to L-TX TX-BLNK. This signal, the same as BLNK 2H, is used to blank the L-TX (ECL02 or higher) during Deuterium decoupling.
$\overline{\text{SEL 2H}}$	This signal is used to command the RF switch located on the 2H amplifier board with the same polarity as a BLNK 2H signal.

Ethernet 10/100 Interface Connector *4.1.3*

The RJ45 connector for the Ethernet 10/100 Mbps link is mounted directly on the BLA Control Board.

Table 4.3. RJ45 Pin Assignment

Pin 1	Transmit + (Tx+)
Pin 2	Transmit - (Tx-)
Pin 3	Receive + (Rx+)
Pin 4	N/A
Pin 5	N/A
Pin 6	Receive - (Rx-)
Pin 7	N/A
Pin 8	N/A

Device Front View 4.1.4

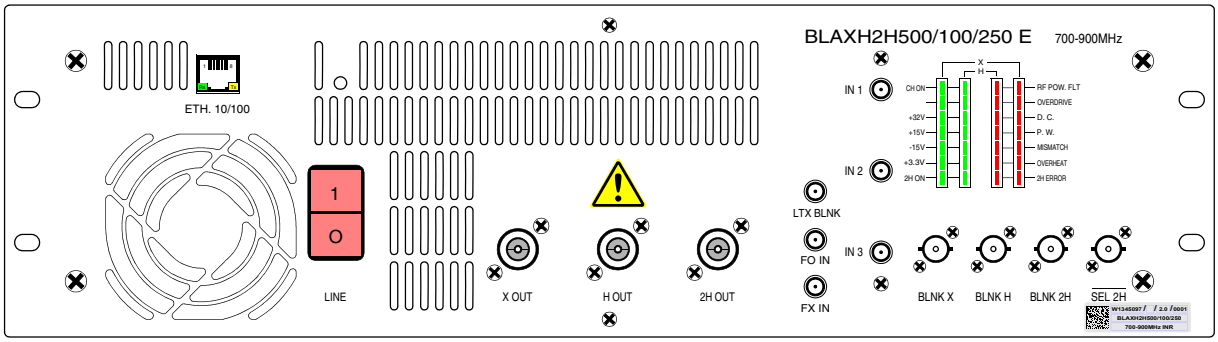

Figure 4.1. BLAXH2H500/100/250 E Amplifier Front Panel Design

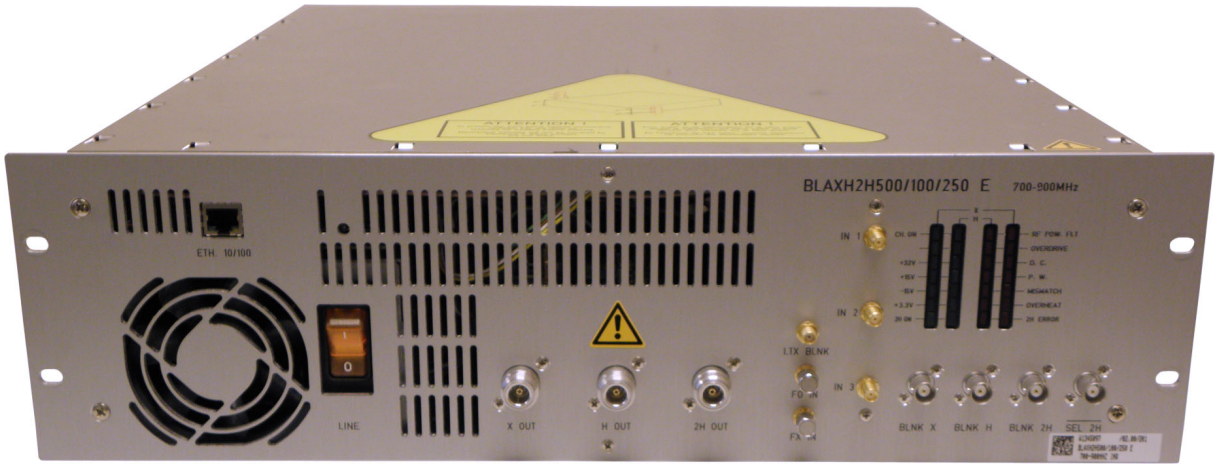

Figure 4.2. BLAXH2H500/100/250 E Amplifier Front Panel View

Rear Panel Description 4.2

The rear Panel of the BLAXH2H500/100/250 E Amplifier 700-900MHz INR is free of elements in exception of the three pole (2P + E) line filter socket.

Device Rear View 4.2.1

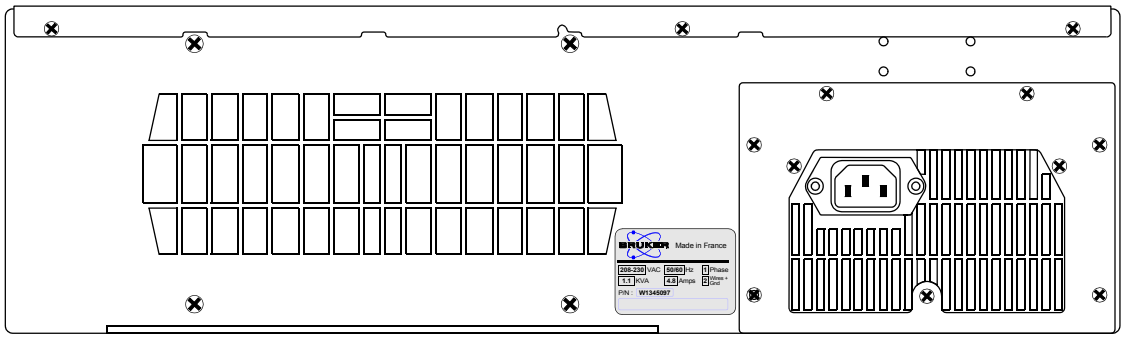

Figure 4.3. BLAXH2H500/100/250 E Amplifier Rear Panel Design

Figure 4.4. BLAXH2H500/100/250 E Amplifier Rear Panel View

Technical Description

5

System Overview 5.1

The BLAXH2H500/100/250 E Amplifier 700-900MHz INR provides :

- A RF Output of 500W on the X channel Output X OUT, over the full frequency range 6 to 365MHz.
- A RF Output of 100W on the H channel Output H OUT, over the full frequency range 650 to 900MHz.
- A RF Output of 150W on the 2H channel Output 2H OUT, over the full frequency range 105 to 155MHz.

The RF section of the system consists of an embedded router fixed on the front panel and a linear module BLMXH2H300/100/150-E, mounted around a single, self-contained Push fan assembly, heatsink.

The embedded router has three RF inputs and two outputs respectively wired to channel H and channel X located on the BLMXH2H300/100/150-E module. The 2H channel is not routed.

The linear module BLMXH2H500/100/250-E includes three class AB power amplifiers. The amplifiers for the H and 2H channels are located on the top side of the module, and the one for the X channel on the bottom side.

X and H channel outputs are connected to the front panel of the amplifier via a bi-directional high dynamic coupler. The 2H channel output is connected directly to the front panel.

The entire system is tied together by a Digital Signal Processing control board, processing information from the amplifier and blanking signal, providing protection to X and H channels from excessive peak power, duty cycle and pulse width for average power, maximum reflected power and heatsink overtemperature.

The DSP control board reads identification information of the amplifier (BIS).
Monitoring of Fan status, Supply status & LED status is also performed by the control board.

Moreover, a 2H-E supervisor board is in relation with the DSP control board, to ensure protection of the 2H channel.
These are the following:

- Duty cycle and Pulse width (Average Power).
- Heatsink overtemperature.
- Fan assembly misfunction.

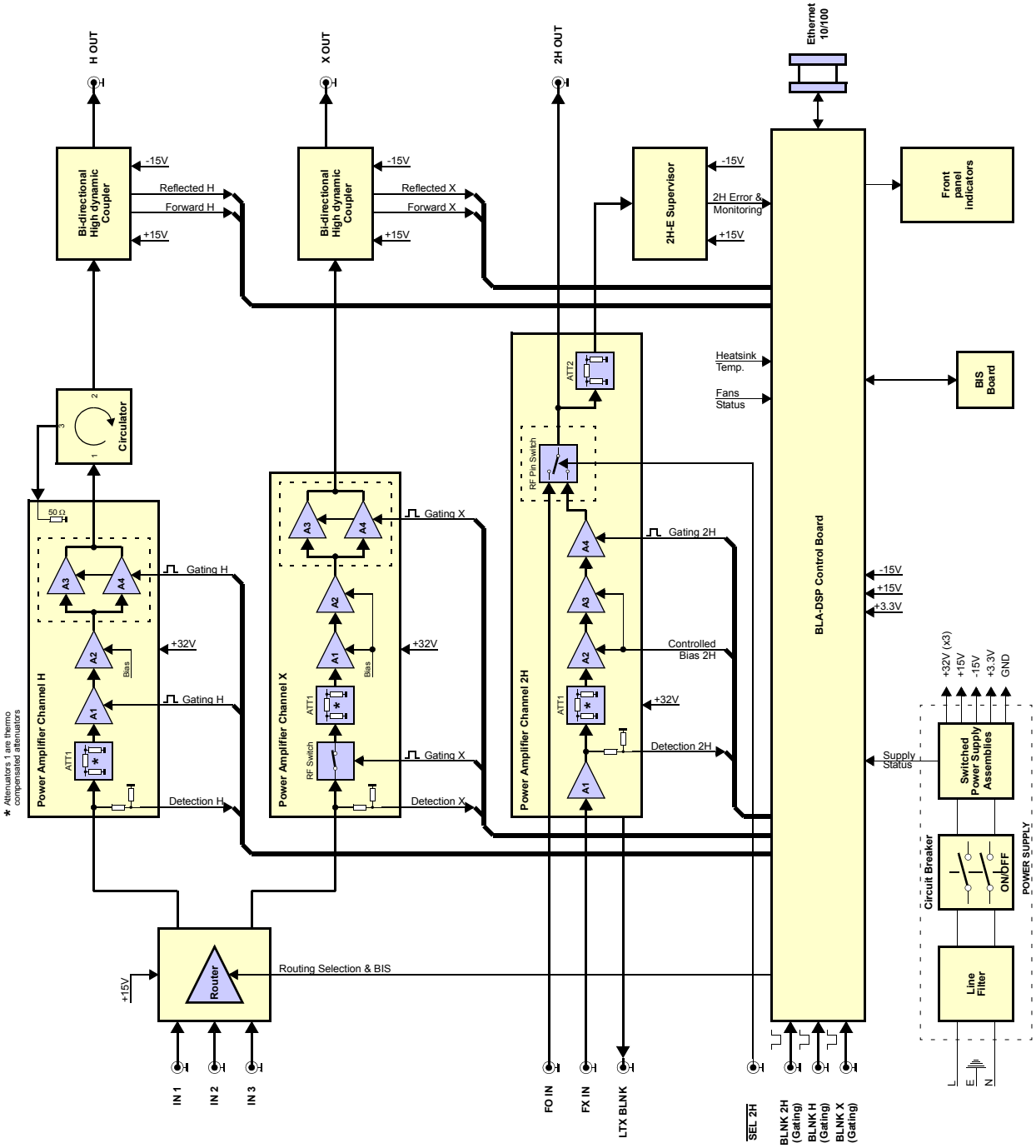

Figure 5.1. BLAXH2H500/100/250 E Amplifier System Block Diagram

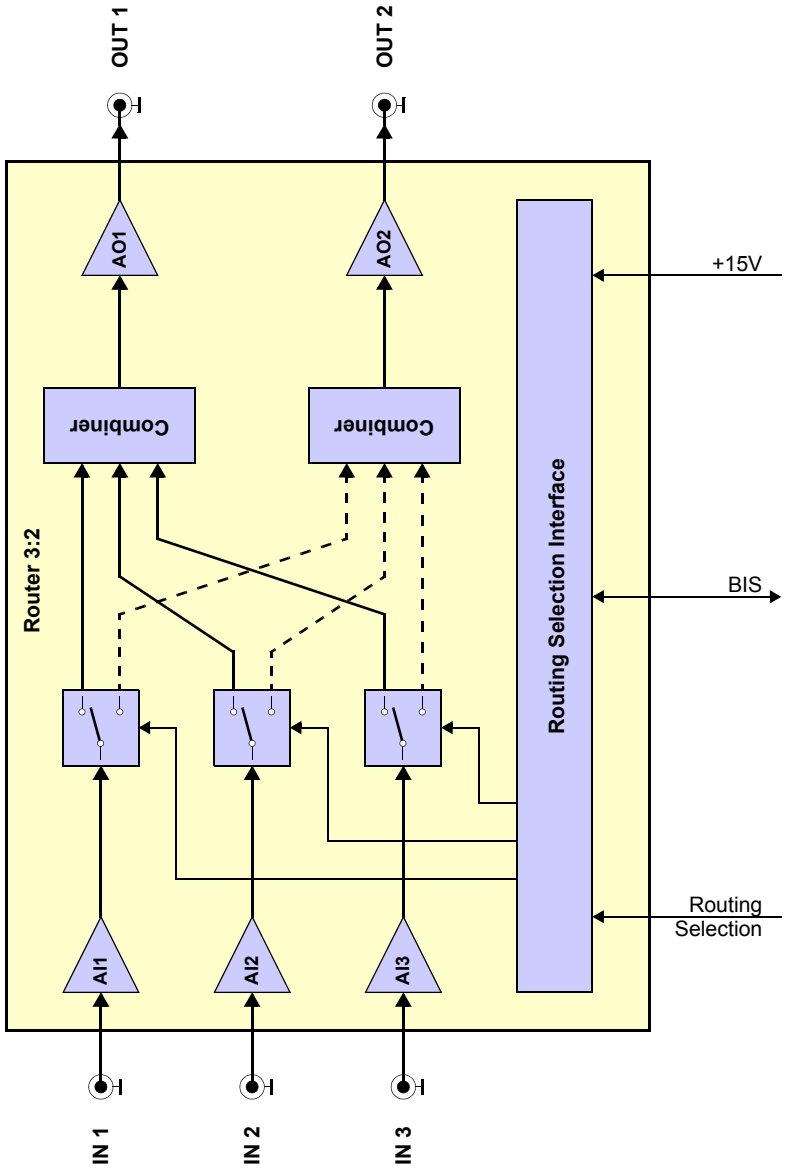

Figure 5.2. Embedded Router Block Diagram

Theory of Operation 5.2

RF Path 5.2.1

The BLAXH2H500/100/250 E amplifier (P/N: W1345097) consists of a 3 inputs embedded router and three Class AB power amplifiers.

A nominal input power level of +4dBm produces a nominal output peak power of :

- 500W for 6% duty cycle at 60ms pulse width maximum on the X channel output.
- 100W for 25% duty cycle at 100ms pulse width maximum on the H channel output.
- 250W for 10% duty cycle at 5ms pulse width maximum on the 2H channel output.

The unit is also capable of longer pulses for lower average power.

Embedded Input Router

The embedded router consists of a class A RF amplifier IC's and RF switches, manufactured on a Gallium Arsenide process.

It is built on a five independent cells architecture with three RF input cells and two output cells. The RF input cells ensure the function of amplification and routing, the output cells ensure the function of combining, RF amplitude thermo-stability and amplification.

The three RF inputs could be routed alone or combined to the first or the second RF output by selecting the wished RF path through the BLA controller board. The same RF input cannot be routed at the same time towards the two RF outputs.

Each entire RF path has a nominal 15dB of gain and operates at +15VDC.

Also, the router is equipped with an EEPROM for BIS information.

RF Power amplifier Channel X500

In the first section of this power amplifier, the RF input signal crosses the RF detection path. Then it is conveyed via an AsGa RF Switch to a thermo compensated attenuator and two class A drivers to build a nominal 25dB to 29dB gain block.

In this section, only the RF switch requires a control board conditioned gating signal to control the operation of the switching element.

The second section of the PA includes two FET transistors.

The circuitry around the transistors consists of complementary input and output transformers and baluns and operates the devices in push-pull.

This section requires a control board conditioned gating signal in order to control the bias gate voltage on the gates of the FETs.

The input-output gain of this section is at nominal 13dB.

The RF power amplifier has a 42dB nominal gain and operates at +32VDC.
With the embedded router gain, the entire RF path has a 57dB nominal gain.

RF Power Amplifier Channel H100

In the first section of this power amplifier, the RF input signal crosses the RF detection path. Then it is conveyed to a thermo compensated attenuator and two class A drivers to build a nominal 24dB gain block.

In this section, only the first class A driver requires a control board conditioned gating signal to control the bias voltage on the gate of the FET.

The second section of the PA includes two FET transistors.

The circuitry around the transistor consists of complementary input and output transformers and baluns and operates the devices in push-pull.

This section requires a control board conditioned gating signal in order to control the bias gate voltage on the gates of the FET.

The input-output gain of this section is at nominal 10dB.

The RF power amplifier has a 34dB nominal gain and operates at +32VDC.
With the embedded router gain, the entire RF path has a 49dB nominal gain.

Circulator on channel H100

A circulator on the output of the H100 channel makes this amplifier absolutely unconditionnally stable for all conditions of mismatches.

RF Power Amplifier Channel 2H250

In the first section of this power amplifier, the input RF signal is fed directly to a hybrid amplifier followed by the RF detection path and a thermo compensated attenuator. Then the RF signal is amplified by two class A drivers to build a nominal 41dB gain block.

The second section of the PA includes a FET transistor.

The circuitry around consists of complementary input and output transformers and baluns.This transistor requires a control board conditionned gating signal in order to control the bias gate voltage. The input-output nominal gain value of this section is 13dB.

The entire RF power amplifier has a 54dB nominal gain and operates at +32VDC.

2H RF Power Switch

The output of the 2H250W power amplifier is connected directly to an RF Power switch, located on the same board. This switch is used to select either the 2H amplifier or the lock transmitter.

It is composed of PIN diodes and provides a 60dB isolation between the 2H OUTPUT and the FO IN input when the 2H amplifier is selected. The PIN diodes switch is selectable by $\overline{\text{SEL 2H}}$ signal for routing FX IN to 2H OUT when the signal is TTL low or FO IN to 2H OUT when the signal is TTL high. PIN diodes also have 0.4dB insertion loss between FO IN and 2H OUT when BLNK 2H signal is TTL high and $\overline{\text{SEL 2H}}$ signal is TTL high. In this mode, the LTX signal can feed through.

RF Coupler X and H

The bi-directional high dynamic couplers on the front panel provide an approximate 1V peak DC signal for full output power and also a peak DC signal for reflected power on channel H and X.

Both signals, forward and reflected, are analyzed by the BLA Control board for monitoring and protection setting.

BLA Control Board *5.2.2*

The BLA Control Board has 3 main functions:

1. Conditions the input blanking (BLNK) signal and delivers it to the above mentioned RF Paths.
2. Allows Ethernet communication with the workstation.
3. Monitor the output characteristics of the amplifier thanks to the DC peak detection of the bi-directional coupler.
   Electronic circuitry processes the detection information and protect the amplifier from overstress like :

- Forward and reflected peak power

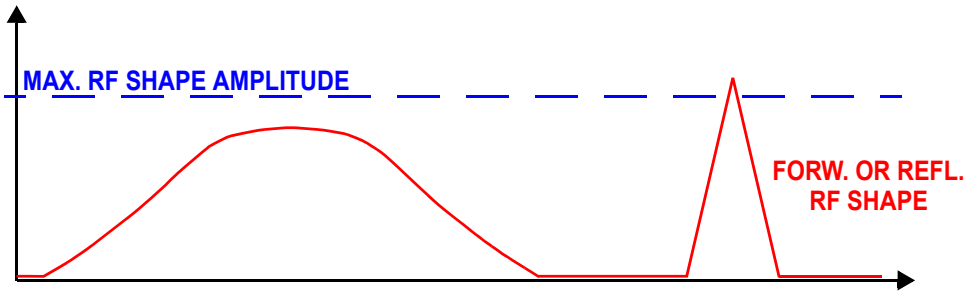

Figure 5.3. Peak Power Limitation

The peak power limitation is the maximum RF forward shape amplitude allowed at the amplifier output.

Limitation range : from 1% to 200% of nominal power.

The peak power limitation is checked for each sample (10 million samples per second), and the maximum peak value is latched then cleared by a read operation (for monitoring purpose).

- Forward pulse width

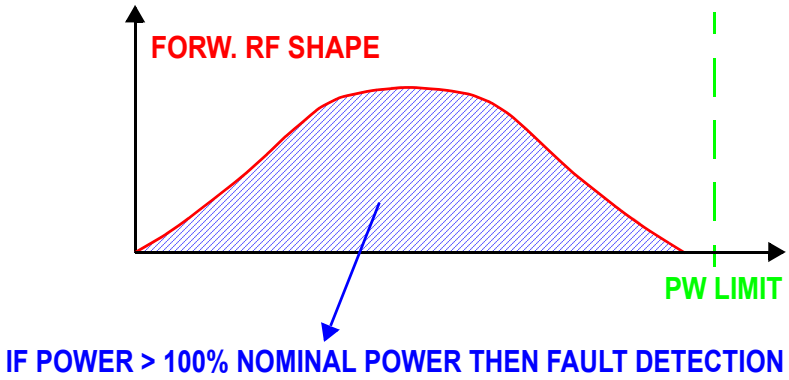

Figure 5.4. Forward Pulse Width Limitation

The pulse width is the lapse of time during which the nominal power can be applied.

Limitation range : from 0.1ms to 512ms.

The pulse width value is updated every 100µs.

- Forward pulse duty cycle

  The duty cycle value is the ratio between measured input power during pulse width limitation value divided by duty cycle limitation value and the nominal power during the same time.

  For example, if the pulse width limitation is set to 3ms and duty cycle is limited to 10%, then duty cycle value equals the measured input power during 30ms (3ms / 0.1) divided by the nominal power during 30ms.

  Limitation range : from 1% to 100%.

  The duty cycle value is updated every 100µs.

- Excess of reflected power (Mismatch)

  The mismatch value is the ratio between the reflected power value and the forward power value.

  Limitation range : from 1% to 100%.

  The mismatch value is updated every 100µs.

- Other protections

  The control board also detects the following faults :

  - Power supply fault

  - Fan failure

  - Heat sink temperature to protect against thermal overstress

  - Fault detection timings

Table 5.1. Fault Detection Timings

Fault	Detection delay (max)
Peak power	500 ns
Duty cycle	100 µs
Pulse Width	100 µs
Mismatch	100 µs
Power Supply, Fan	200 ns
Heat sink temperature	500 ms

Peak, pulse width, duty cycle, mismatch and also mean power values can by read out at any time from the main DSP for monitoring purpose.

- Fault protection reset.

If one of these overstresses appears the board automatically resets the fault flags after 2 seconds, the gating signal is disabled and the status led board on the front panel displays the fault.

This means, for example, that when a pulse width fault occurs, the amplifier channel is disabled after the detection delay. The side effect is that the fault condition disappears since the channel's output power is null.

After 2 seconds, the channel is switched on and the cycle begins again (unless the channel RF input signal is re-adjusted to meet the power limitations).

2H-E Supervisor Board *5.2.3*

The 2H RF output power is coupled via resistive coupling to the 2H-E Supervisor board. This board is in relation with the BLA Control board and ensures basics functions of :

- 2H RF output power monitoring,
- Protection against Duty cycle and Pulse width overstresses (average power),
- Indication of 2H RF output power presence.

BLA Extension Board *5.2.4*

This board gives the information to the control board of RF detection.

Status Led Board *5.2.5*

The status led board, on the front panel of the amplifier, displays overstress functions, supplies status, and so on, as described in ***"Indicators" on page 15*** and ***"BLA Control Board" on page 24***.

BIS Board *5.2.6*

The universal BIS board is located on the amplifier case and contains identifications of the amplifier.

Technical help : please contact your local representative.

Servicing the BLA 6

The BLAXH2H500/100/250 E Amplifier 700-900MHz INR provides diagnosis and servicing web pages relies on HTTP, allowing service access with any web browser.

Accessing the BLA Amplifier 6.1

The BLAXH2H500/100/250 E Amplifier 700-900MHz INR is accessible via the BLA control board with its IP address.

The IP address is given during "**cf**" by using TOPSPIN 2.5x or better software on the workstation.

In case of problems :

- Check the RJ45 cabling between amplifier, Ethernet switch and workstation.
- Check the Ethernet switch power.
- Check if the green LED on the amplifier RJ45 connector lights up.
- Check the front panel of the amplifier, LED's indicators +32V, +15V, -15V and +3.3V ON must have lit.

To access the BLAXH2H500/100/250 E Amplifier 700-900MHz INR, type "**ha**" in TOPSPIN 2.5x or better and choose the BLA that should be accessed or start your favourite web browser and type the given IP address as URL.

Sub Toolbar Information 6.2

Device Information (default) 6.2.1

You should get the following start screen.

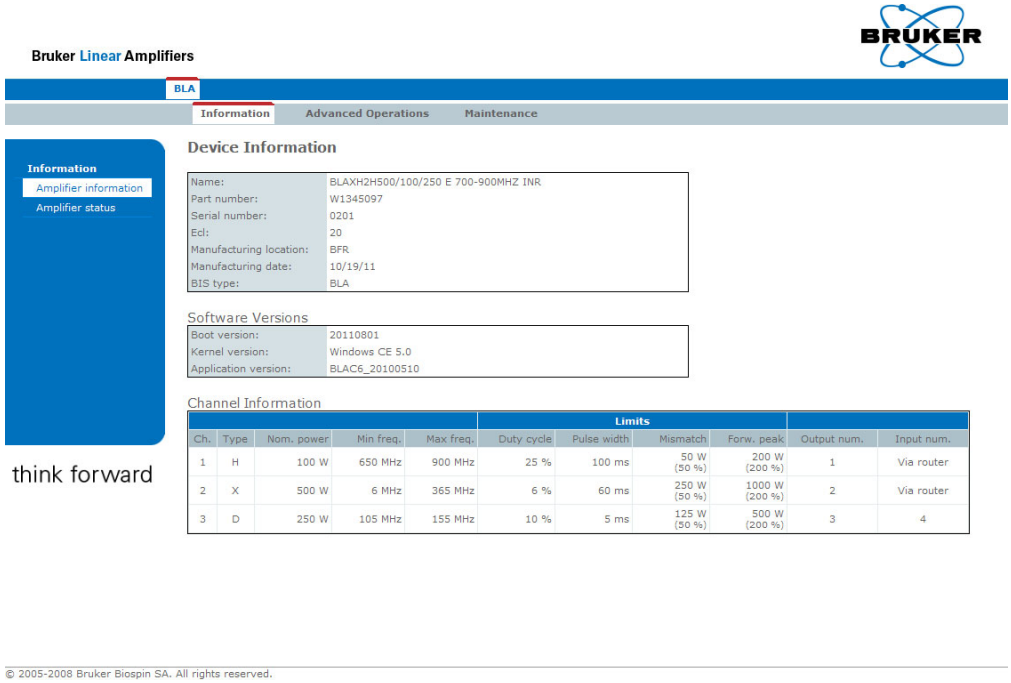

Figure 6.1. Device Information

This page gives you general information about the amplifier (default page).

In the main toolbar, we can see that a BLA is displayed.

The left panel is the navigation menu. It can be used to navigate through the service pages or choose another tab in the sub toolbar.

Amplifier Status *6.2.2*

Leads you to a page giving information about the current status of the amplifier.

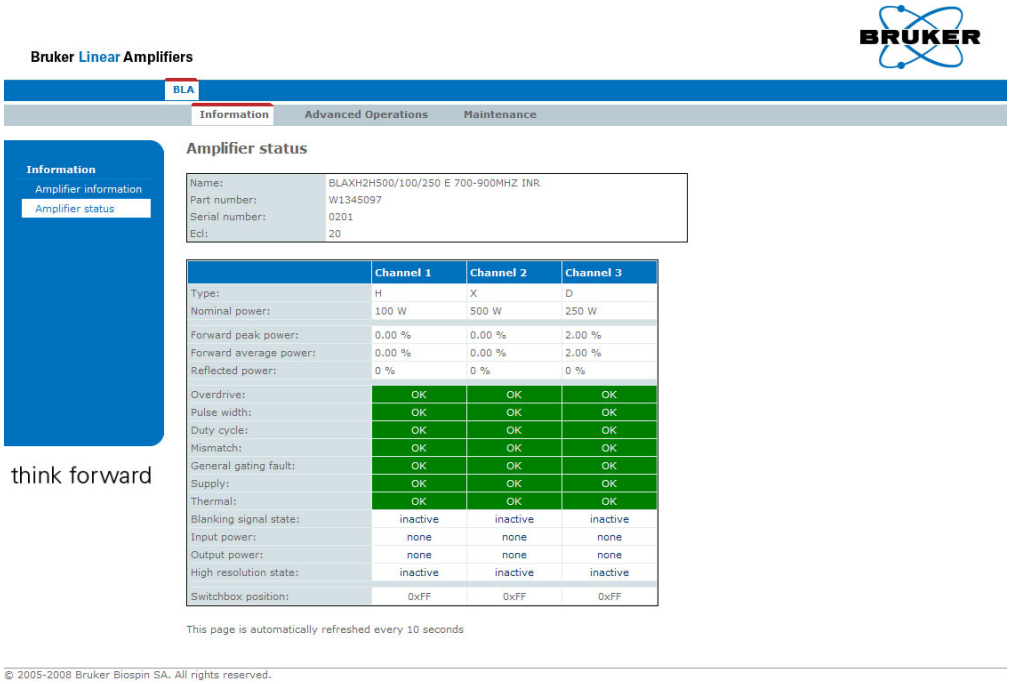

Figure 6.2. Amplifier Status

Sub Toolbar Advanced Operations 6.3

Device Information (advanced) 6.3.1

You should get the following start screen.

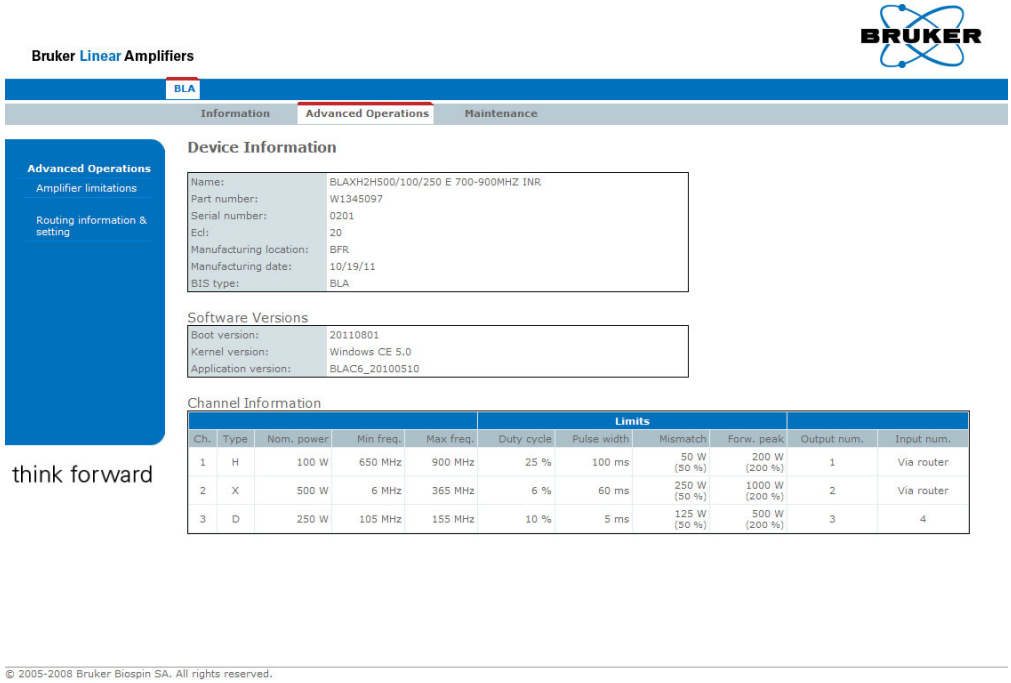

Figure 6.3. Device Information

This page gives you general information about the amplifier.

The left panel is the navigation menu. It can be used to navigate through the service pages or choose another tab in the sub toolbar.

Amplifier Limitations *6.3.2*

Leads you to a page giving several default and current limits of the amplifier.

If you want, for any reasons, to change the current limits of the amplifier, press ***Change limits***.

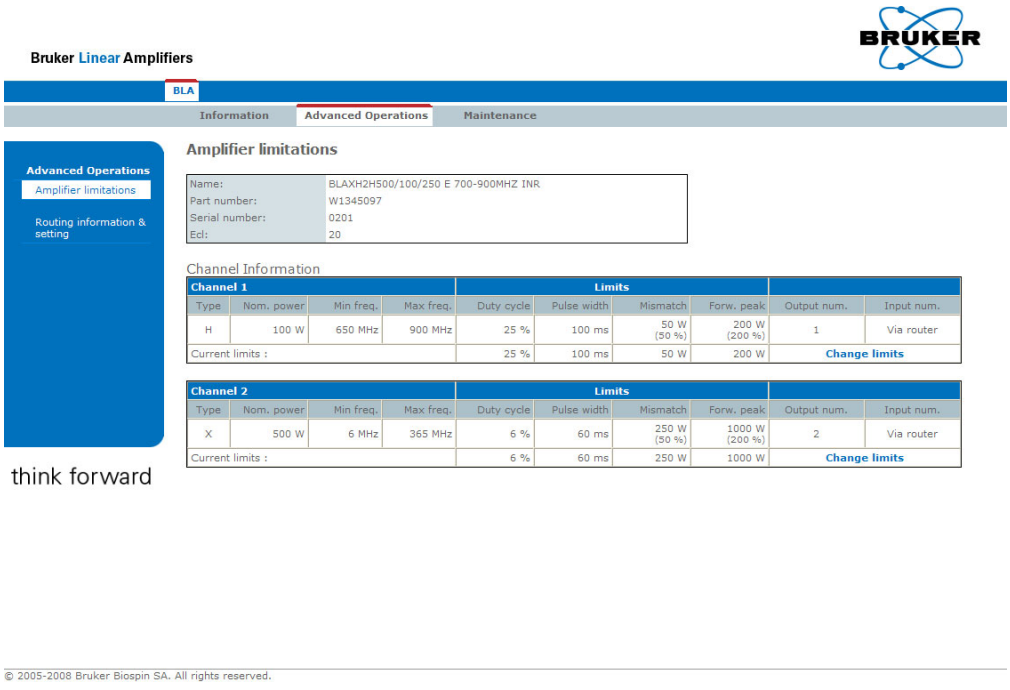

Figure 6.4. Amplifier Limitations

Change Limits *6.3.3*

Read the warnings, change limit parameters and press ***Apply*** if you are sure of that.

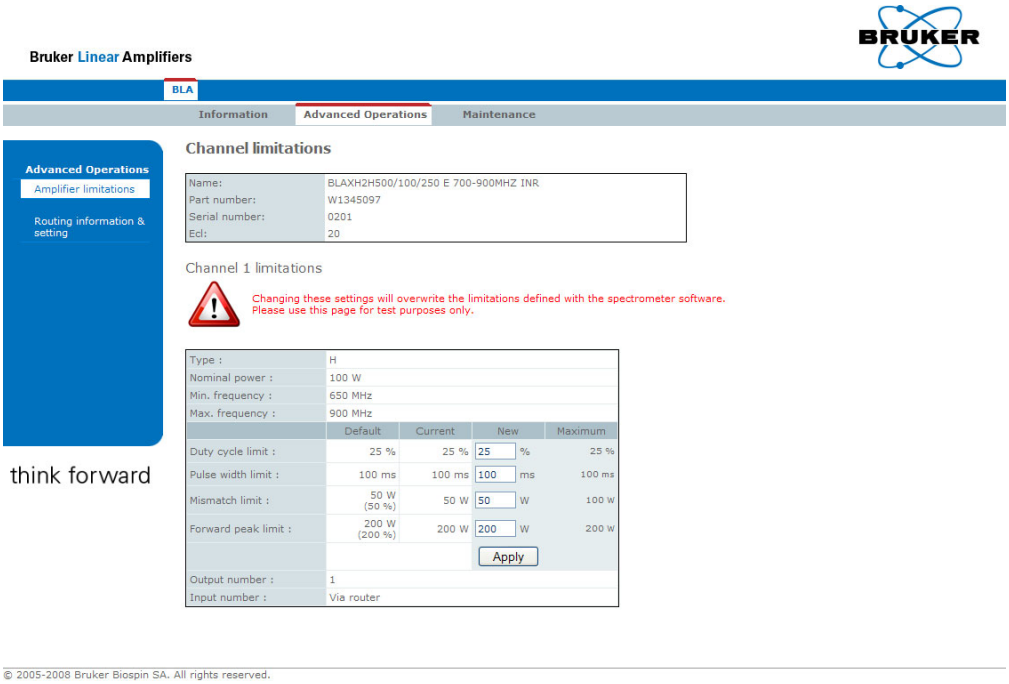

Figure 6.5. Change Limits (Channel H)

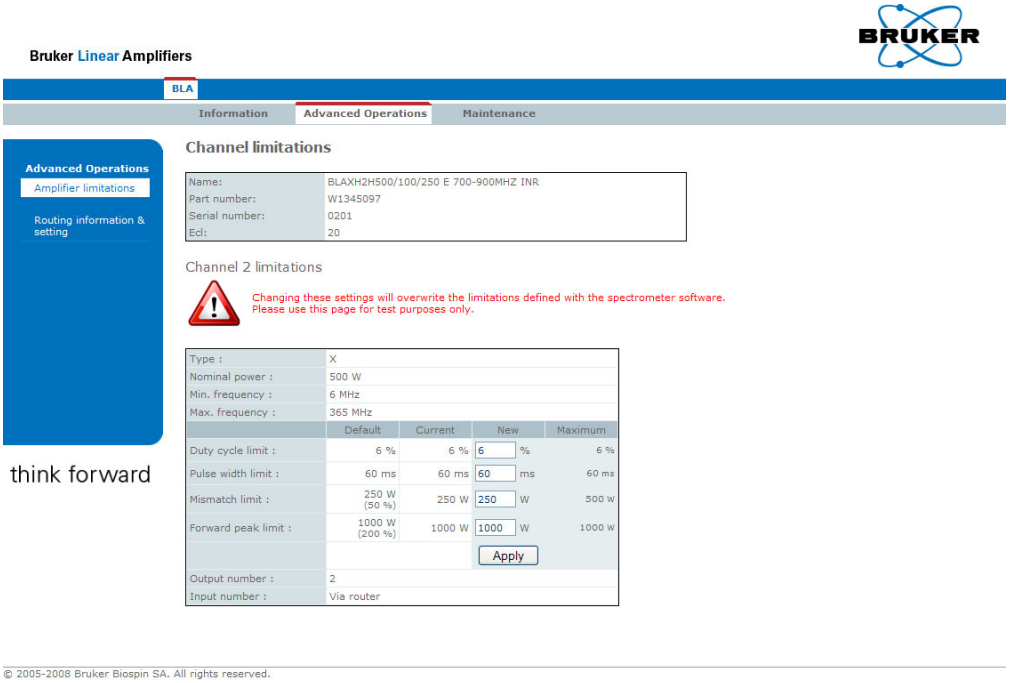

Figure 6.6. Change Limits (Channel X)

Routing Information and Setting *6.3.4*

Leads you to a page giving information about the current routed RF path at the amplifier inputs.

Default RF paths are INPUT 1 to CHANNEL 1 and OUTPUT 2 to CHANNEL 2.

2H RF path is fixed route.

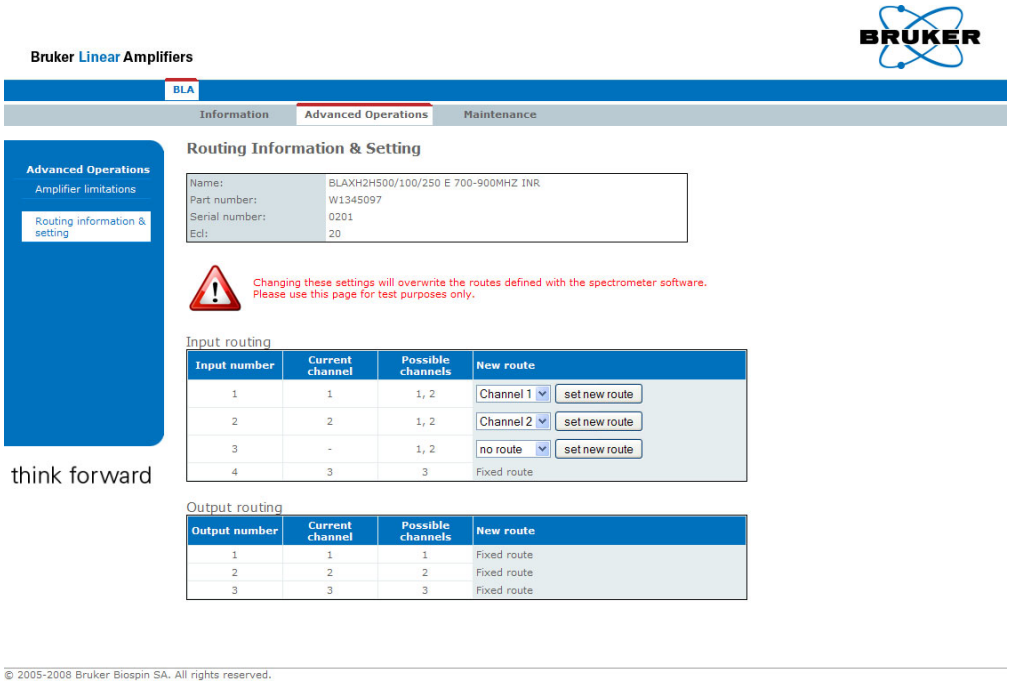

Figure 6.7. Routing Information and Setting

Read the warnings, it is allowed to change routing configuration of the input router and the output router (ex: new route INPUT2 to CHANNEL1 and INPUT3 to CHANNEL2), press ***set new route*** if you are sure of that.

Sub Toolbar Maintenance 6.4

Device Information (maintenance) 6.4.1

You should get the following start screen.

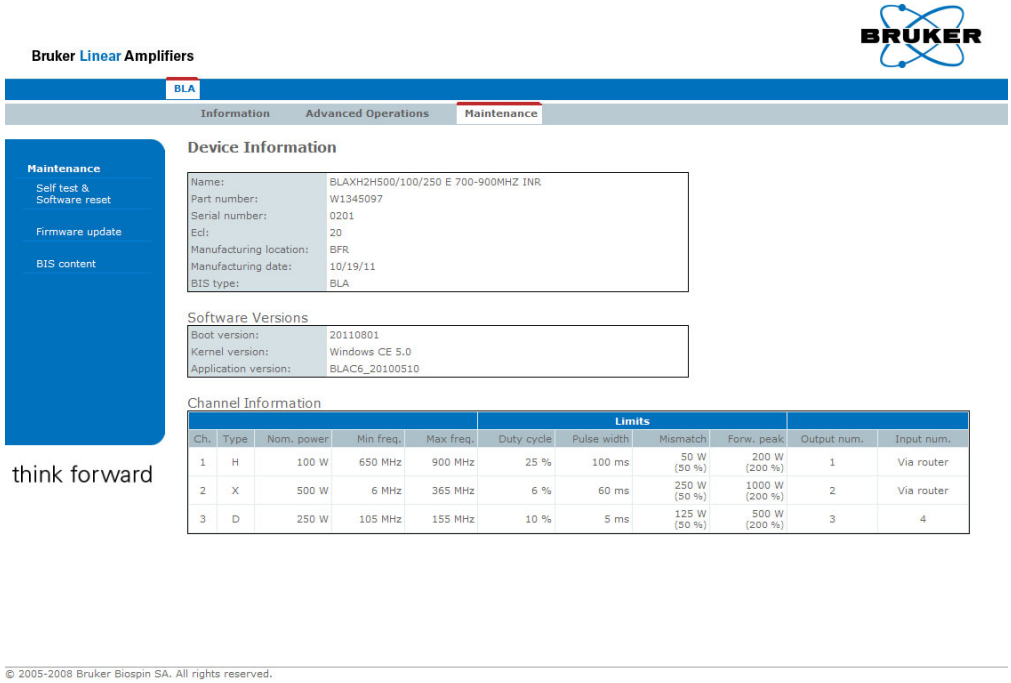

Figure 6.8. Device Information

This page gives you general information about the amplifier.

The left panel is the navigation menu. It can be used to navigate through the service pages or choose another tab in the sub toolbar.

Self-Test & Software Reset *6.4.2*

Leads you to a page allowing you to do a self-test on the BLA control board (Hardware test) and to do a software reset.

Both operations can be done if the amplifier doesn't work correctly.

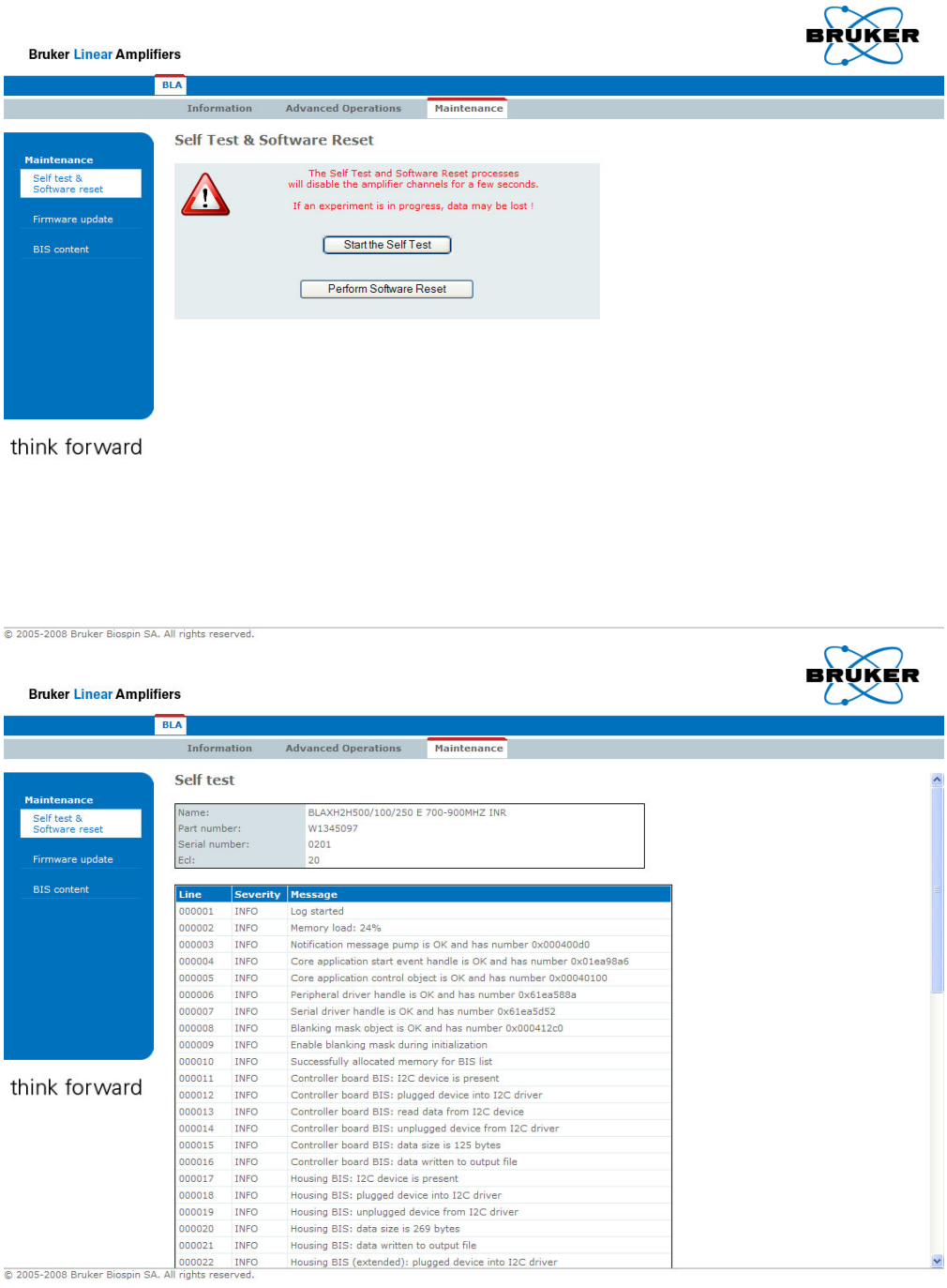

Figure 6.9. Perform Self Test and Report

Read the warnings, press ***Start the Self Test***.

You should have only gray lines in the report.

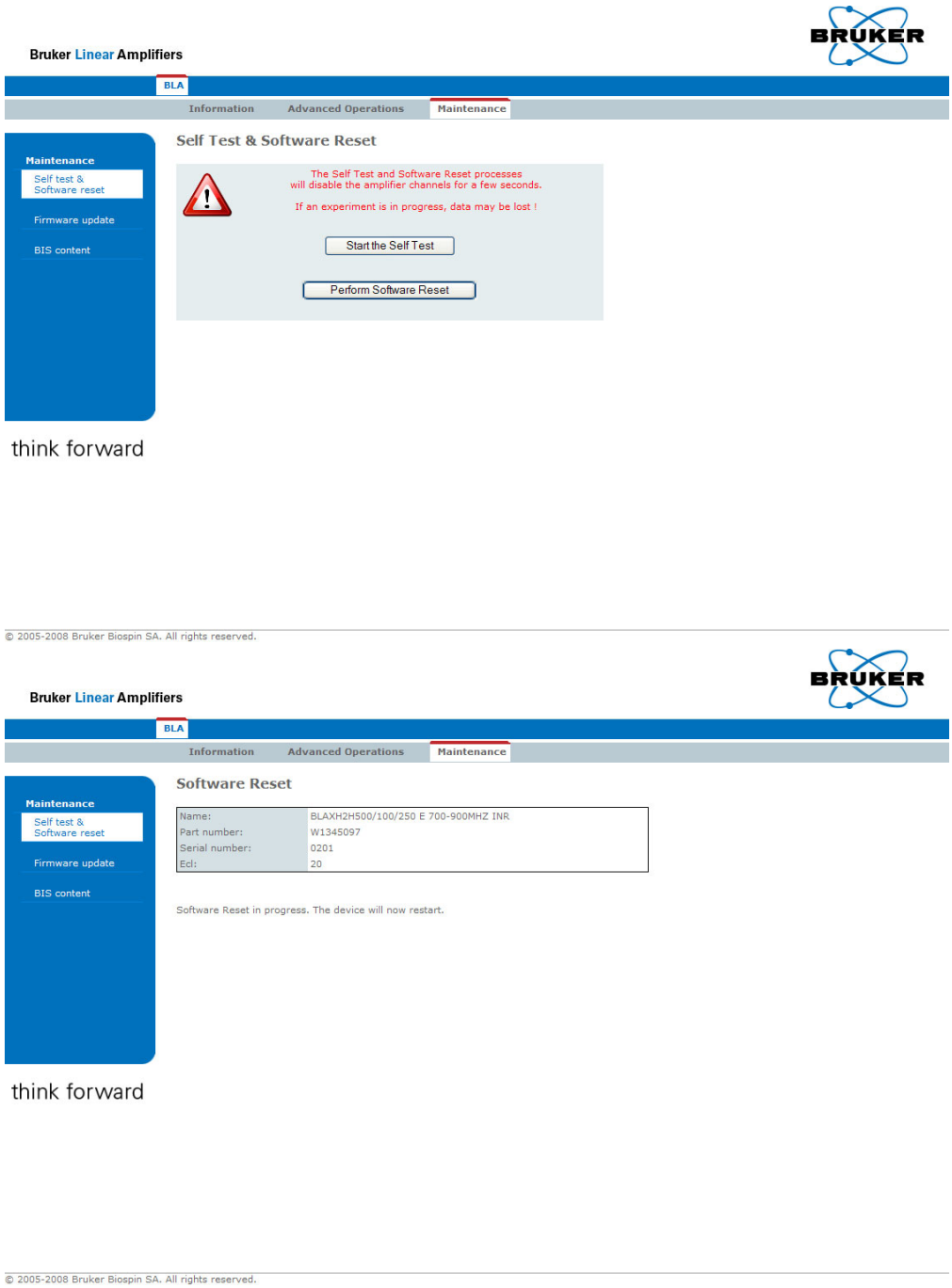

Figure 6.10. Perform Software Reset and Report

Read the warnings, press ***Perform Software Reset***.

You should have the following screen.

Firmware Update *6.4.3*

Leads you to a page allowing you to download new firmware.

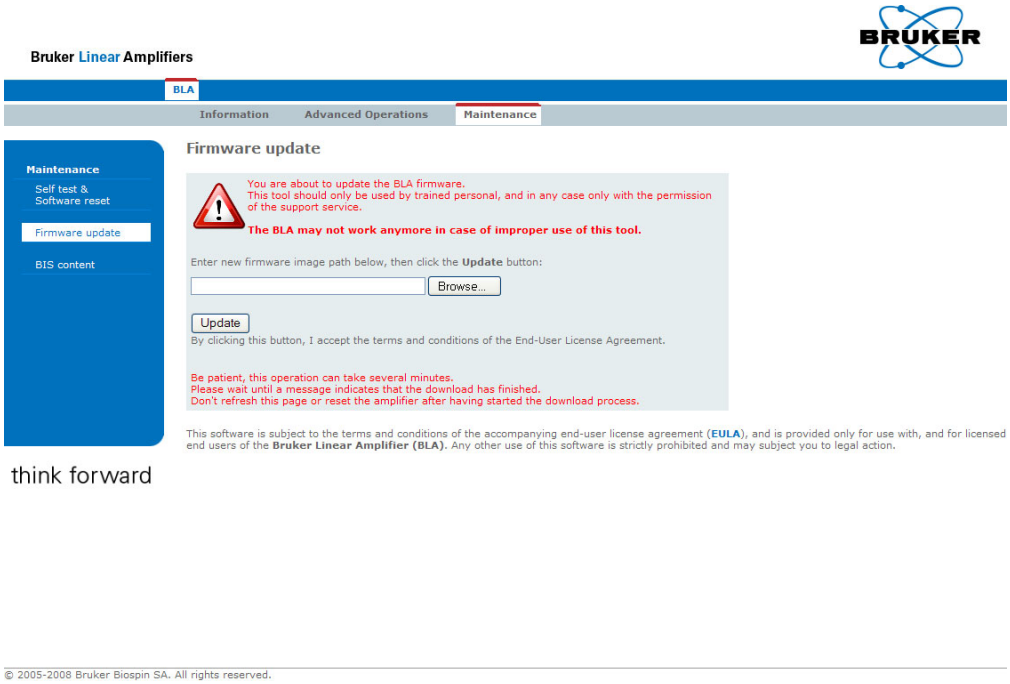

Figure 6.11. Firmware Update

Read the warnings, press the ***Browse*** button for selecting the new firmware file to download and press ***Update***. Download the new firmware will take a few minutes.

NOTE : This button caption depends on your operating system language settings.

BIS Content *6.4.4*

Leads you to a page giving information about the current BIS programmed on the amplifier.

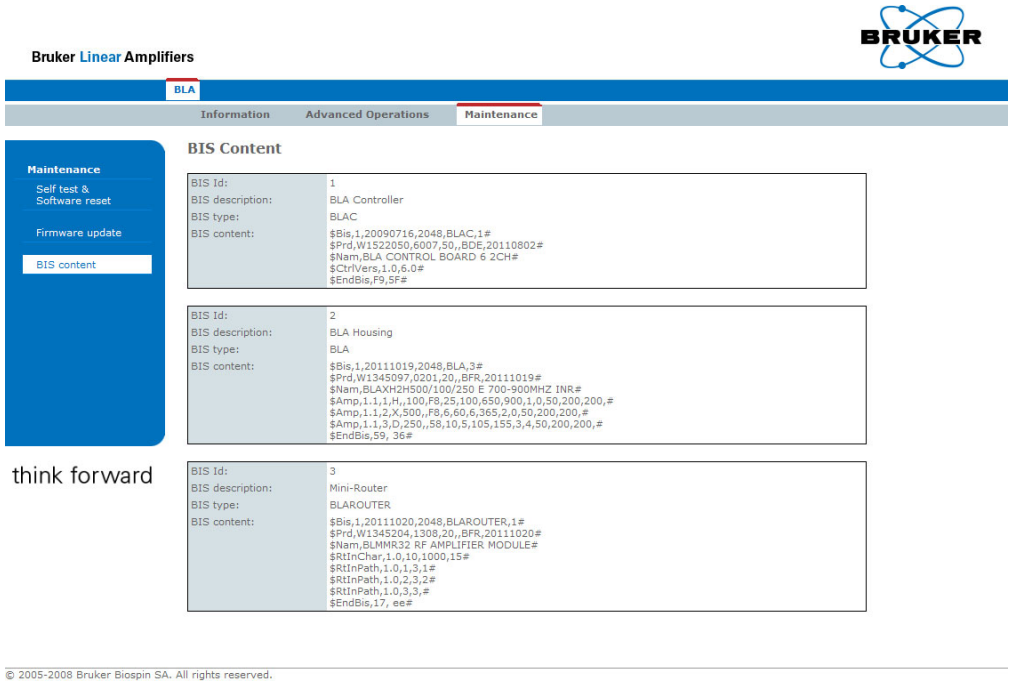

Figure 6.12. BIS Content

Specifications 7

Common Characteristics 7.1

Table 7.1. Amplifier Common Characteristics

Constant Internal Protection	Supplies, fans faults and over temperature. Forward Power : peak & CW power, pulse width and duty cycle. Reflected Power : peak & CW power, pulse width and duty cycle for 2H channel.
Front Panel Indicators	Amplifier Status Led Board.
Front Panel Interfaces	1 x I/O 8 pins RJ45 connector.
Front Panel Controls	1 x AC line ON/OFF switch, 1 x SEL 2H switch selection signal.
Front Panel Connectors	5 x RF input, 3 x RF output, 3 x blanking input (gating), 1 x blanking output (gating).
Rear Panel Connectors	1 x AC line in socket.
Cooling System	Forced-air cooling (from front to rear).
Size	19" rack cabinet x 3U height x 520mm depth.
Weight	23kg
Power Requirements	208-230 VAC ± 10% single phase 50-60Hz. Bruker Biospin part number W1304006. Consumption max. 1.1kVA.

General Specifications 7.2

Channel X 500W Output 7.2.1

Table 7.2. Channel X 500W Output Specifications

Frequency Range	6 to 365MHz
Linear Gain	57dB ±1dB typical
Gain Flatness	±1dB max.
Minimum Pulsed Output Power (@ nominal Input +4dBm)	600W typical from 20 to 100MHz 500W typical to 300MHz 400W min. to 365MHz
CW Output Power (Internal Limitation)	30W max.
Linear Output Power	400W typical @ 1dB compression
Linearity	±1dB to 400W typical
Amplifier Biasing	Class AB operation
Blanking Delay Time	1µs min.
RF Rise Time	< 100ns
RF Fall Time	< 50ns
DC Ringing	±500mV typical (due to blanking signal)
Input Noise Figure	9dB typical
Output Noise Power (Unblanked)	-108dBm @ 1Hz
Output Noise Power (Blanked)	< 25dB over Thermal Noise
Input/Output Impedance	50Ω
Input V.S.W.R. Route OFF	1.2 max.
Input V.S.W.R. Route ON	1,3 max. (100 to 365MHz) (up to 1.9 max. @ 20MHz)
Output Harmonics (2fc ; 3fc)	-30dBc ; -10dBc max. @ 500W
Pulse Width (Internal Limitation)	60ms @ 500W (up to CW @ 30W)
Duty Cycle (Internal Limitation)	6% @ 500W (up to 100% @ 30W)
Droop & Pulse Flatness	±4% typical @ 500W for 20ms Pulse Width ±2% typical @ 500W for 1ms Pulse Width
Amplitude Stability vs. Temperature	±0.1% / °C max.

Channel H 100W Output *7.2.2*

Table 7.3. Channel H 100W Output Specifications

Frequency Range	650 to 900MHz
Linear Gain	49dB ±1dB typical
Gain Flatness	±1.5dB max.
Minimum Pulsed Output Power (@ nominal Input +4dBm)	100W full range
CW Output Power (Internal Limitation)	25W max.
Linear Output Power	80W typical @ 1dB compression
Linearity	±1dB to 80W typical
Amplifier Biasing	Class AB operation
Blanking Delay Time	1µs min.
RF Rise Time	< 100ns
RF Fall Time	< 50ns
DC Ringing	±200mV typical (due to blanking signal)
Input Noise Figure	9dB typical
Output Noise Power (Unblanked)	-116dBm @ 1Hz
Output Noise Power (Blanked)	Thermal Noise
Input/Output Impedance	50Ω
Input V.S.W.R. Route OFF	1.5 max.
Input V.S.W.R. Route ON	1.5 max.
Output Harmonics (2fc ; 3fc)	-40dBc ; -60dBc max. @ 100W
Pulse Width (Internal Limitation)	100ms @ 100W (up to CW @ 25W)
Duty Cycle (Internal Limitation)	25% @ 100W (up to 100% @ 25W)
Droop & Pulse Flatness	±3% typical @ 100W for 100ms Pulse Width
Amplitude Stability vs. Temperature	±0.1% / °C max.

Channel 2H 150W Output *7.2.3*

Table 7.4. Channel 2H 250W Output Specifications

Frequency Range	105 to 155MHz
Linear Gain	54dB ±0.5dB typical
Gain Flatness	±0.5dB max.
Minimum Pulsed Output Power (@ nominal Input +4dBm)	300W typical from 105 to 155MHz 270W min. to 155MHz
CW Output Power (Internal Limitation)	25W max.
Linear Output Power	250W typical @ 1dB compression
Linearity	±1dB to 250W typical
Amplifier Biasing	Class AB operation
Blanking Delay Time	3µs min. (due to PIN diodes switch commutation)
RF Rise Time	< 500ns (due to PIN diodes switch commutation)
RF Fall Time	< 50ns
DC Ringing	N/A
Input Noise Figure	6dB typical
Output Noise Power (Unblanked)	-114dBm @ 1Hz
Output Noise Power (Blanked)	< 27dB over Thermal Noise
Input/Output Impedance	50Ω
Input V.S.W.R.	1.4 max. (No Router)
Output Harmonics (2fc ; 3fc)	-20dBc ; -20dBc max. @ 250W
Pulse Width (Internal Limitation)	5ms @ 250W (up to CW @ 25W)
Duty Cycle (Internal Limitation)	10% @ 250W (up to 100% @ 25W)
Droop & Pulse Flatness	±5% typical @ 250W for 5ms Pulse Width
Amplitude Stability vs. Temperature	±0.2% / °C max.

Table 7.5. Channel 2H 250W Pin Diode Switching Specifications

Insertion FO_IN vs 2HOUT	0,4dB typical
Isolation 2HOUT vs FO_IN	> 60dB full range

Service Information and Maintenance 8

Every intervention on the device must be carried out by an authorized and qualified person. Any failure due to a non-respect of the following instructions will not be attributable to BRUKER BIOSPIN and will not be covered by the guarantee clauses.

Preventive Maintenance of the RF Module on BLA-Type Amplifiers *8.1*

The RF module inside BLA's Amplifiers is equipped with a easily extractible PUSH FAN Assembly.

Fan's on assembly have a high reliability and manufacturer gives a expected live time of 70000 hours (8 years) at 25°C and 5 years at 60°C.

Replacement of the assembly could be done in the field when a misfonction of fans is detected by lightning from the OVERHEAT Status Led.

To prevent such a misfonction, a preventive maintenance could be done every 4 years.

This assembly can be ordered on the manufactory BBIO-FR by P/N:

- **W1346523** «PUSH FAN ASSEMBLY 6».

Operation *8.1.1*

Read below or see SIH0292.

1. Disconnect all cables from the front panel and the supply connector on the rear panel. Remove the amplifier from the NMR console and place it on a secure flat surface.
2. Unscrew and remove the coverage plate from the amplifier.
3. Disconnect the 2 wires (red +32V / black GND) from the RF module dispatch supply connectors and disconnect the fan status wires (white) from BLA Control board connector J18.

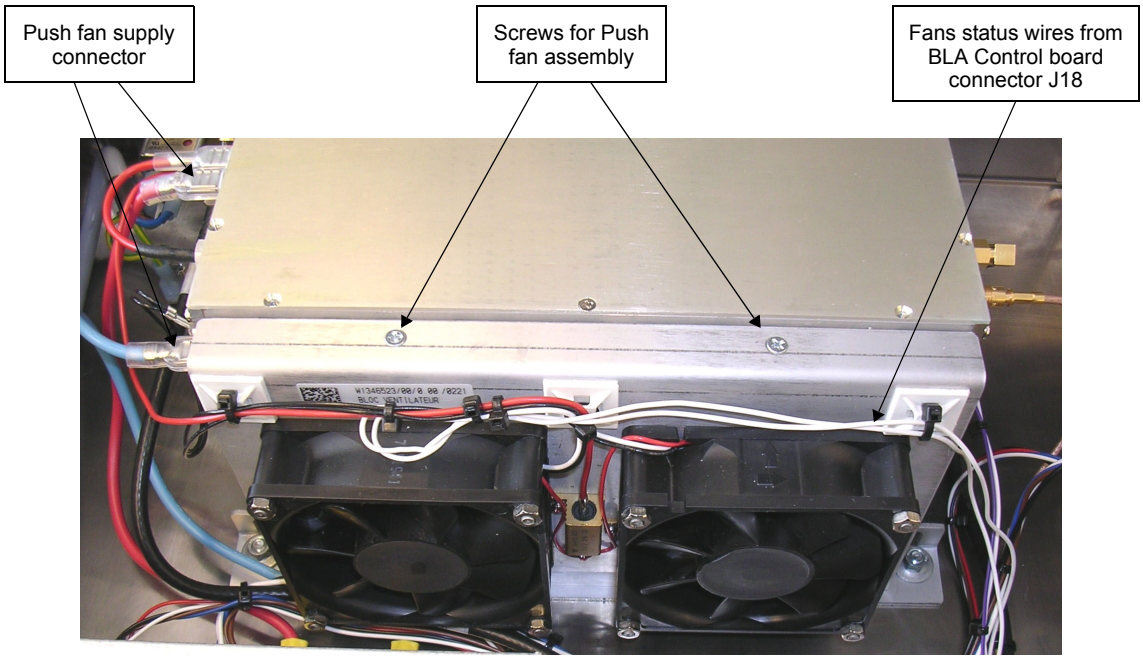

Figure 8.1. Push Fan Assembly

4. Unscrew the 2 screws from the top of the push fan assembly.
5. Remove the push fan assembly.
6. Place correctly the new fan assembly in the bottom holes from the RF module and screw it.
7. Connect all wires (status and supply).
8. Connect line cord and turn on the BLA amplifier. Note that the fans are turning and no OVERHEAT status led appears on front panel.
9. Put the coverage plate on the BLA amplifier and screw it.
10. Put the amplifier in the NMR console, connect all cables on the front panel and the line cord on the rear panel.

Figures

1 General Information *5*

2 Safety *7*

Figure 2.1. Identifying Plate 7
Figure 2.2. Manufacturer's Name Plate 8

3 Installation *11*

4 Operation *15*

Figure 4.1. BLAXH2H500/100/250 E Amplifier Front Panel Design 17
Figure 4.2. BLAXH2H500/100/250 E Amplifier Front Panel View 17
Figure 4.3. BLAXH2H500/100/250 E Amplifier Rear Panel Design 18
Figure 4.4. BLAXH2H500/100/250 E Amplifier Rear Panel View 18

5 Technical Description *19*

Figure 5.1. BLAXH2H500/100/250 E Amplifier System Block Diagram 20
Figure 5.2. Embedded Router Block Diagram 21
Figure 5.3. Peak Power Limitation 24
Figure 5.4. Forward Pulse Width Limitation 24

6 Servicing the BLA *27*

Figure 6.1. Device Information 28
Figure 6.2. Amplifier Status 29
Figure 6.3. Device Information 30
Figure 6.4. Amplifier Limitations 31
Figure 6.5. Change Limits (Channel H) 32
Figure 6.6. Change Limits (Channel X) 32
Figure 6.7. Routing Information and Setting 33
Figure 6.8. Device Information 34
Figure 6.9. Perform Self Test and Report 35
Figure 6.10.Perform Software Reset and Report 36
Figure 6.11.Firmware Update 37
Figure 6.12.BIS Content 38

7 Specifications *39*

8 Service Information and Maintenance *43*

Figure 8.1. Push Fan Assembly 44

Figures

Tables

1 General Information *5*

2 Safety *7*

3 Installation *11*

4 Operation *15*

Table 4.1. Indicators Assignment 15
Table 4.2. Coaxial Connectors Assignment 16
Table 4.3. RJ45 Pin Assignment 16

5 Technical Description *19*

Table 5.1. Fault Detection Timings 25

6 Servicing the BLA *27*

7 Specifications *39*

Table 7.1. Amplifier Common Characteristics 39
Table 7.2. Channel X 500W Output Specifications 40
Table 7.3. Channel H 100W Output Specifications 41
Table 7.4. Channel 2H 250W Output Specifications 42
Table 7.5. Channel 2H 250W Pin Diode Switching Specifications 42

8 Service Information and Maintenance *43*

Tables

End of Document

Bruker BioSpin, your solution partner

Bruker BioSpin provides a world class, market-leading range of analysis solutions for your life and materials science needs.

Bruker BioSpin Group

info@bruker-biospin.com
www.bruker-biospin.com